

## AUTOMATIC DETERMINATION METHOD FOR COLOR SCANNING MODE OF SCANNER

### BACKGROUND OF THE INVENTION

#### Field of the Invention

[0001] The invention relates in general to an automatic determination method for a scanner, and more particularly, to an automatic determination method of the color scanning mode for a scanner.

#### Description of the Related Art

[0002] The computer has become an indispensable necessity of everyday life. As computers become more and more advanced, the techniques of multi-media have become better and better developed. Image processing has also improved, leading to the development of many computer peripheral image processors such as the scanner. In only a few years, the palm black-and-white scanner has developed into a full color high resolution scanner, which produces images of fine quality and fidelity.

[0003] In the past, when using a scanner, the user had to manually configure the scanning mode of the scanner. A lot of time was wasted configuring the scanning mode, making the application of the scanner very inconvenient.

### SUMMARY OF THE INVENTION

[0004] The invention provides an automatic determination method of color scanning mode for a scanner. The previewed image data is analyzed to determine which scanning mode is appropriate. A scanning operation is performed according to the

determined result. Therefore, without manual configuration by the user, a reasonable and correct scanning mode can be determined.

[0005] The automatic determination method of color scanning mode for a scanner includes the following steps. Image data previewed by the scanner is used to determine whether a black-and-white scanning mode is suitable. If it is suitable, the black-and-white scan is performed, if not, it is determined whether the gray scale scanning mode is suitable. If so, the gray scan is performed, if not, the color scan is performed.

[0006] In one embodiment of the invention, while determining whether the black-and-white scanning mode is suitable, the pixel of the previewed image data is divided into a low brightness area and a high brightness area. A low brightness mean value and a low brightness standard deviation are calculated from the low brightness area, and a high brightness mean value and a high brightness standard deviation are calculated from the high brightness area. When the low brightness mean value and standard deviation are smaller than a predetermined low brightness mean value and standard deviation, and the high brightness mean value is greater than a predetermined high brightness mean value and the standard deviation is smaller than a predetermined standard deviation, the black-and-white scan is performed.

[0007] In the automatic determination method of color scanning mode in the above embodiment, a formula  $E_{total} = \sum_{m=0}^{m=n-1} \left[ \sum_{x=R,G,B} |L_x - L|/3 \right]$  can be used to determine whether a

gray scale scan is appropriate. In this formula,  $L = (L_R + L_G + L_B)/3$ ,  $L_R$  indicates the brightness of the red color,  $L_G$  indicates the brightness of the green color, and  $L_B$  indicates the brightness of the blue color. The image data has  $n$  pixels. Each pixel has a different brightness for red color ( $L_R$ ), green color ( $L_G$ ), and blue color ( $L_B$ ). When the average

displacement of the red, green and blue colors for the  $n$  pixels ( $E_{total}$ ) is smaller than a predetermined value ( $E_r$ ), the gray scale scan is performed. When  $E_{total} > E_r$ , the color scan is performed.

[0008] By being able to analyze the previewed image data, the invention can automatically determine the suitable scanning mode.

[0009] Both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Figure 1 shows a color scanning mode determination method of a scanner according to the invention;

[0011] Figure 2 shows the method illustrated in Figure 1, in which it is determined whether a black-and-white scanning mode is suitable; and

[0012] Figure 3 shows the method illustrated in Figure 1, in which it is determined whether a gray scanning mode is suitable.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] In Figure 1, an embodiment of an automatic determination method for color scanning mode of a scanner is shown. According to image data previewed by the scanner, in step 110 it is determined whether a black-and-white scanning mode is suitable. When the black-and-white scanning mode is suitable, the black-and-white scan is performed in step 120. When the black-and-white scanning mode is not suitable, in step 140 it is determined whether the gray scale scanning mode is suitable. When the gray scale

scanning mode is not suitable, the color scan is performed in step 150.

[0014] Referring to Figure 1 and Figure 2, a method to determine whether the black-and-white scanning mode is suitable is shown. The previewed image data is divided into a low brightness area and a high brightness area in step 210. The brightness range of the low brightness range is about 0-127, while the brightness range of the high brightness range is about 128-255. The mean values and standard deviations of the low and high brightness areas are calculated in step 220. That is, the low brightness mean value *mean A* and the standard deviation *standard deviation A* are calculated from the low brightness area, and the high brightness mean value *mean B* and the standard deviation *standard deviation B* are calculated from the high brightness area. The mean values and standard deviations are compared to predetermined values in step 230. When the low brightness mean value *mean A* and standard deviation *standard deviation A* are smaller than the predetermined low brightness mean value *mA* and standard deviation *sA*, and the high brightness mean value *mean B* is larger than the predetermined high brightness mean value *mB*, and the standard deviation *standard deviation B* is smaller than the predetermined standard deviation *sB*, the black-and-white scanning mode is appropriate. The black-and-white scan is then performed in step 120. When *mean A* > *mA*, *standard deviation A* > *sA*, *mean B* > *mB*, and *standard deviation B* > *sB*, the black-and-white scanning mode is not suitable. Whether the gray scale scanning mode is suitable is determined in step 130.

[0015] Referring to Figures 1 and 3, the method to determine whether the gray scale scanning mode is appropriate is shown. In Figure 3, an average brightness of the R, G, B colors for each pixel of the previewed image data is obtained in step 310. This step can be presented as:

$$L=(L_R+L_G+L_B)/3$$

$L_R$  is the brightness of the primary red color,  $L_G$  is the brightness of the primary green color, and  $L_B$  is the brightness of the primary blue color. The previewed image data has  $n$  pixels, the brightness of different primary colors of each pixel is denoted by  $L_R$ ,  $L_G$ ,  $L_B$ , and  $L$  is the average of these three values for each pixel. The displacement of the pixels is then

5 calculated in step 320. A mathematical formula  $E_{total} = \sum_{m=0}^{m=n-1} \left[ \sum_{x=R,G,B} |L_x - L| / 3 \right]$  is used to calculate the total brightness displacement  $E_{total}$  of the red, green and blue colors for  $n$  pixels. The total brightness displacement  $E_{total}$  is compared to the predetermined value  $E_r$  in step 330. When  $E_{total} < E_r$ , the gray scale scanning mode is suitable, so that the gray scan is performed in step 140. If  $E_{total} > E_r$ , the gray scanning mode is not suitable, and the color scan is performed in step 150.  $n$  is a positive integer number larger than 1. The above

10 formula can also be  $L = L_R + L_G + L_B$  and  $E_{total} = \sum_{m=0}^{m=n-1} \left[ \sum_{x=R,G,B} |L_x - L| \right]$ . Though the values are not the same, the determination can also be achieved.

**[0016]** The invention thus has the advantage that the scan mode is automatically determined. The user does not have to judge the correct scan mode of the scanner by

15 himself/herself.

**[0017]** Other embodiments of the invention will appear to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples are to be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.